

SEC 108/0A/WO

Claims

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1. A projection apparatus (1) for projecting an image onto a projection screen (17), comprising
an imaging device (11) for representing the image at
10 a reduced scale,
an illumination unit (2) with a lamp (3) and a condenser system (4) and/or a lamp reflector, preferably a focusing lamp reflector, for illuminating the imaging device (11),
15 a projection assembly (10) comprising a projection lens (12) and provided for imaging the image represented by the imaging device (11) enlarged on the projection screen (17), and
a spatial light mixing system (7) for compensating
20 local differences in the brightness distribution, characterized in that
it comprises an adjustable alignment deflecting mirror (19) that is arranged in the illumination path of the imaging device (11) and is provided for adjusting the illumination of the imaging device (11),
25 wherein the position of said alignment deflecting mirror (19) that is defined by tilt angles can be adjusted by changing the tilt angles, more particularly the polar and azimuthal angles of the beam reflected, by means of setting elements, wherein
30 the alignment reflecting mirror (19) is arranged in the light path between the lamp (3) and the light mixing system (7).

2. A projection apparatus (1) according to claim 1,
characterized in that the alignment deflecting mirror
(19) is arranged between the condenser system (4) of
the illumination unit (2) or a lamp reflector and the
imaging device (11).
3. A projection apparatus (1) according to the preceding
claim, characterized in that further condenser lenses
for illuminating the imaging device (11) are arranged
between the alignment deflecting mirror (19) and the
imaging device (11).
4. A projection apparatus (1) according to any one of
the preceding claims, characterized in that the light
incoming surface (13) of the spatial light mixing
system (7) is arranged in or in the immediate
vicinity of the focal plane of the condenser (4) of
the illumination unit (2) or a lamp reflector.
5. A projection apparatus (1) according to any one of
the preceding claims, characterized in that the spa-
tial light mixing system (7) is a device, more par-
ticularly a light mixing rod (8), extending in the
direction of light propagation.
6. A projection apparatus (1) according to any one of
the preceding claims, characterized in that the
alignment deflecting mirror (19) is arranged between
the condenser (4) of the illumination unit (2) or a
lamp reflector and the light incoming surface (13) of
the spatial light mixing system (7).
7. A projection apparatus (1) according to anyone of the
preceding claims, characterized in that it comprises

an illumination sensor (16) for determining the intensity of the illumination of the imaging device (11) provided by the illumination unit (2).

- 5 8. A projection apparatus (1) according to the preceding claim, characterized in that it comprises an optical outcoupling element (26) for coupling out a part of the luminous flux generated by the illumination unit (2) for illuminating the imaging device (11), wherein
10 said outcoupling element (26) is arranged in the illumination path between the illumination unit (2) and the imaging device (11) and couples the light out of the light path on its way from the illumination unit (2) to the imaging device (11).
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9. A projection apparatus (1) according to any one of the preceding claims, characterized in that the outcoupling element (26) is arranged between the output of the spatial light mixing system (7) and the imaging device (11).
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10. A projection apparatus (1) according to any one of claims 8 through 9, characterized in that the outcoupling element (26) is a semi-transparent mirror (27).
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11. A projection apparatus (1) according to any one of claims 7 through 10, characterized in that it comprises drivable setting elements (23) for adjusting the position of the alignment deflecting mirror (19) and a control unit, which can be used to align the
30 position of the alignment deflecting mirror (19) in relation to the signal of the illumination sensor (16).

12. A projection apparatus (1) according to the preceding claim, characterized in that the alignment deflecting mirror (19) is automatically aligned by the control unit.

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13. A projection apparatus (1) according to any one of the preceding claims, characterized in that it comprises one or more diaphragms that can be inserted in the path of light, preferably two slotted diaphragms arranged in transverse direction to each other, for
10 adjusting the alignment deflecting mirror (19).

14. A projection apparatus (1) according to any one of the preceding claims, characterized in that the
15 illumination unit (2) is arranged in an illumination module (24) and the projection assembly (10) is arranged in a separate projection module (25).

15. A projection apparatus according to the preceding
20 claim, characterized in that the imaging device (11) and the projection lens (12) are arranged in the projection module (25).

16. A projection apparatus (1) according to any one of
25 claims 14 through 15, characterized in that the alignment deflecting mirror (19) and the condenser system (4) of the illumination unit (2) or the lamp reflector are arranged in the illumination module (24).

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17. A projection apparatus (1) according to any one of claims 14 through 16 and according to claim 3, characterized in that further condenser lenses are arranged in the projection module (25).

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18. A projection apparatus (1) according to any one of claims 14 through 17, characterized in that the illumination module (24) contains two or more lamps.
- 5 19. A projection apparatus (1) according to any one of claims 14 through 18, characterized in that the illumination module (24) contains an electronic lamp driver required for operation of the lamp (3) and a power supply unit.
- 10 20. A projection apparatus (1) according to any one of claims 14 through 19, characterized in that the illumination module (24) has a volume in excess of that of the projection module (25).
- 15 21. A projection apparatus (1) according to any one of claims 14 through 20, characterized in that the illumination module (24) has a mass in excess of that of the projection module (25).
- 20 22. A projection apparatus (1) according to any one of claims 14 through 21, characterized in that it comprises alignment means for fine-aligning the image projected, wherein said alignment means can be used
25 to adjust the position of the projection module (25) in the projection apparatus (1).
- 30 23. A projection apparatus (1) according to any one of claims 14 through 22, characterized in that the position of the illumination module (24) is fixed in the projection apparatus (1) or that the illumination module (24) comprises alignment means for coarse-aligning the position of the illumination module (24) in the projection apparatus (1).

24. A projection apparatus (1) according to the preceding claim, characterized in that the illumination module (24), after having been subjected to a service measure, or an exchanged illumination module can be
5 inserted in the projection apparatus (1) without an alignment of the projection module (25) becoming necessary therein.
25. A projection apparatus according to any one of the
10 preceding claims, characterized in that it is designed as a rear projection apparatus.
26. A projection wall, comprising a plurality of projection apparatuses (1) according to any one of the
15 preceding claims.
27. A method for adjusting the illumination of an imaging device (11) of a projection apparatus (1) for projecting an image onto a projection screen (17),
20 comprising
an imaging device (11) for representing the image at a reduced scale,
an illumination unit (2) with a lamp (3) and a condenser (4) and/or a lamp reflector, preferably a
25 focusing lamp reflector, for illuminating the imaging device (11), and
a projection assembly (10) comprising a projection lens (12) and provided for imaging the image represented by the imaging device (11) enlarged on the
30 projection screen (17), and
a spatial light mixing system (7) for compensating local differences in brightness distribution,
characterized in that

an adjustable alignment deflecting mirror (19) for
adjusting the illumination of the imaging device (11)
is arranged in the illumination path of the imaging
device (11), wherein the position of said alignment
5 deflecting mirror (19) that is defined by tilt angles
can be adjusted by changing the tilt angles, more
particularly the polar and azimuthal angles of the
beam reflected, by means of setting elements, wherein
the alignment reflecting mirror (19) is arranged in
10 the light path between the lamp (3) and the light
mixing system (7).

28. A method according to claim 27, characterized in that
it comprises a feature of a projection apparatus (1)
15 according to any one of claims 2 through 25.